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ABSTRACT

This document reports on the development of a measurement model aimed at determining preference for sex and number of children in a family. These new scales reflect the utility for sex and number of children, disentangle their separate effects, and provide independent measures of each. They are sensitive to deviations from a first choice, and index an underlying preference structure that is often at variance with a stated first preference. Two advances in psychological measurement theory provide the basis for the models and measures developed and tested in both the experimental and field data. The authors detail the development of both the model, using conjoint measurement theory, and the scales, using the unfolding theory. Six different models of family composition have been tested in exploratory work to date. They range from the simplest--that the utility for a boy adds to the utility for a girl to give the utility for a family--to a threshold model which implies some sort of stopping rule, such as having at least one or two sons. The most viable model asserts that the relevant variables are the total number of children and the algebriac difference between the number of boys and the number of girls preferred. A cross-cultural analysis of scale validity is reviewed. (Author/PC)

MEASURING CONJOINT PREFERENCES FOR FAMILY COMPOSITION

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The need for better measures of preference for sex and number of children came sharply into focus in cross-cultural work on son preference, but it has also been highlighted by the many recent fertility models which include variables for utility (or taste or preference) for children, but usually with the measurement models and procedures for indexing this utility unspecified. In developing indices to meet this need, a measurement-theoretic approach appears very promising. The new scales reflect the utility for sex and number of children, disentangle their separate effects and provide independent measures of each. They are sensitive to deviations from a first choice and index an underlying preference structure that is often at variance with a stated first preference.

Two advances in psychological measurement theory provide the basis for the models and measures developed and tested to date in both experimental and field data. Conjoint measurement theory provides the models, and unfolding theory the scales. Very briefly, unfolding theory gives a technique for obtaining psychological scales derived from a theory of preferential choice. It is based on the idea that an individual has a personal ideal point on a variable x, such as an amount of sugar in his coffee or a number of children, and that his preference falls off as x either increases or decreases, the slope depending on the psychological distance from his ideal. Such a preference function is a single-peaked utility function, and the preference order, reflecting the person's

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utility, is the x scale monotonically transformed and folded at his ideal point. (Two models of such preference functions and the matrices giving their related preference orders are shown in Figures 1 and 2.)

The second development, conjoint measurement, provides tests of rules of combinations, which are theories or models of how individuals put variables together psychologically, in this case, the number and sex of children they want. Rules for independence and additivity which require only ordinal data provide tests for the models. If these rules are satisfied, then the variables are truly independent of each other, have no inherent interaction, and one may be indexed without specifying the level of the other. This is a very useful feature in theory building and in empirical work. Since the models used determine which data are appropriate for the construction of the scales, it is important that they can and have been tested empirically. Briefly, in order for the data to satisfy the model, the ordering of preferences in the matrix must conform to specific patterns.

The basic data required to test the models and develop the measures are simple: a preference order for the 16 family compositions resulting from all the combinations of 0-3 boys and 0-3 girls, a matrix with 16 family composition entries. (Another shorter form, feasible for use in large field studies, has been used successfully in Taiwan and in the United States.) Matrices obtained from methodological samples at the University of Michigan and in Taiwan indicate that 90 percent of the respondents had single-peaked preference functions. So the theory is satisfied in this regard.

Six different models of family composition have been tested in exploratory work to date. They range from the simplest, that the utility

for a boy adds to the utility for a girl to give the utility for a family (illustrated in Figure 1), to a threshold model which implies some sort of stopping rule, such as having at least one or two sons. But the most viable model asserts that the relevant variables are the total number of children and the algebraic difference between the number of boys and the number of girls preferred (the NxS model illustrated in Figure 2). About 85 percent of the University of Michigan respondents fit this model quite well. The fit was slightly less good in the Taiwan data, partly because of more "noise" under those field conditions. This is being tested further in a number of cultures, but to date it is clearly the best to use empirically as no other model fits more than 5 percent of the cases.

Under the NxS model, the data for constructing the scales must come from the two major diagonals of the matrix of choices ordered by the respondent. Each possible preference order corresponds to a particular interval on a psychological continuum which is given an I-scale number (Figure 3). While the theory on which the scales is based is complicated, a simple table can be used to translate preference orders to I-scale values (Table 1). In this case they range from 1 to 7, indicating a range from a small to a large family preference for number bias, and from a strong girl to a strong boy preference for sex bias. IS-4 indicates a preference for sex balance (not for indifference; indifference to either number or sex of children can be tested for explicitly--so far we have found only 17 such cases, out of 625, for sex and none for number). These scales for number and for sex are independent of each other, can be related to individual or aggregate data, and can be compared across cultures. (The range of number of children can be expanded if necessary, and results made

comparable.)

Let me give some illustrative uses. First, because the scales are sensitive to deviations from a first choice, the underlying preference structure measured is often very different from the respondent's stated first preference (Table 2). For example, two individuals may both say they want two children, but one may be an IN-2 (indicating a preference for a small family) and the other an IN-4 (a preference for a moderately large family). The first person is psychologically closer to 0 than to 4 children; the second, closer to 6 than to 0. They clearly have different underlying preference characteristics that may affect their fertility behavior. Similarly, the first preference for number of boys and girls may be quite different from the underlying sex bias or preference structure.

We also find respondents with low number but high sex preference scales, clearly a potential conflict situation, especially in cultures which put a premium on having boys (Table 3). If such conflict exists, the matrix data provide a measure on the question of dominance.

Cross-cultural comparisons of distributions and mean scale values for University of Michigan, United States, and Taiwan pretest samples show clear differences (in Table 4). The higher values for both number and sex in Taiwan reflect cultural differences. Scale values are also related to use of contraception and potentially to future fertility.

Let me add a word about validity—it is often said that respondents in some cultures don't have a clear idea of the number of children wanted; the scales procedure doesn't force the person to choose a single specific number, but allows her to order choices as she likes best. It is also said that respondents may give an answer, frequently too low, in order to please

the interviewer. This stance is difficult to maintain through a series of choices, particularly as the respondent is unaware of the scale procedure or of what would please. Other points could be raised, but perhaps the best test of validity is pragmatic--predictive power. Earlier development of scales for number preference alone, used with longitudinal Detroit data, proved remarkably predictive. Consistently, women with higher I-scale values had higher fertility during a five-year followup period, even with controls for parity, first preference, education, income, and religion (Table 5).

These theoretically clarified and improved measures of number and sex bias can be studied separately as independent variables affecting fertility, and as dependent variables affected by the stream of events including the process of family building. This development appears to have real possibilities for an area of study which has suffered from ad-hoc measures.

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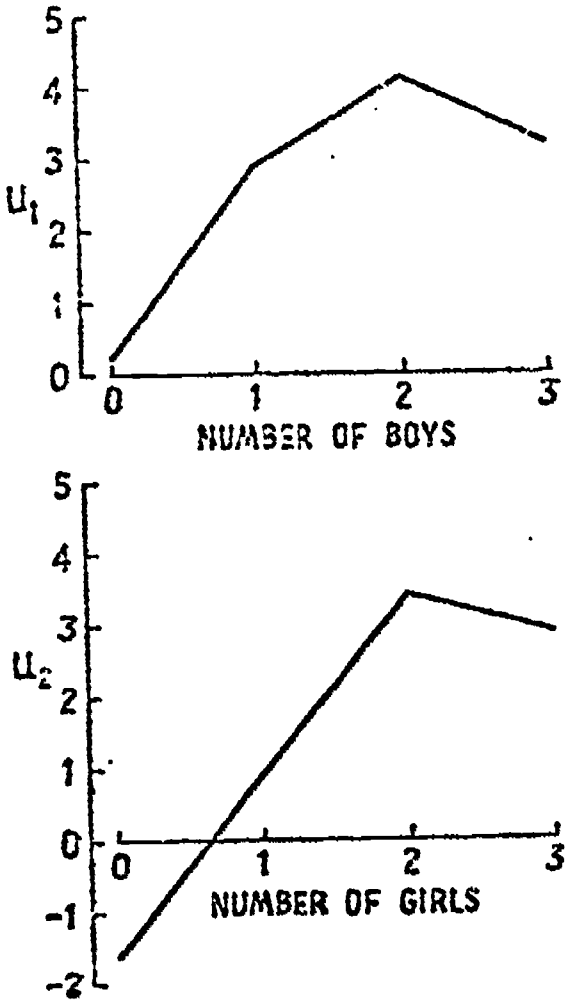
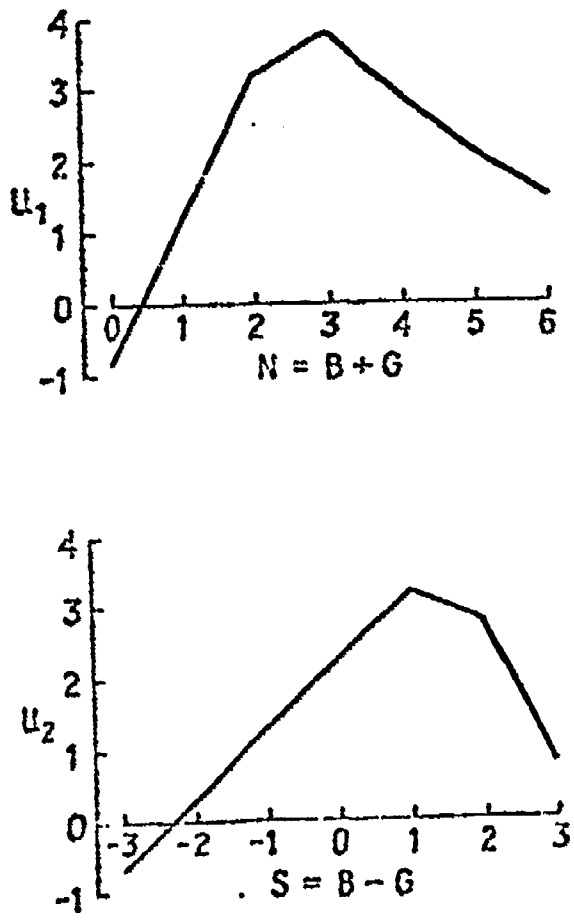
Figure 1. A Boy by Girl Model (BxG)



U_1(B)	Number of Boys	U_2(G) = -1.6	.9	3.4	2.9
		Number of Girls: 0	1	2	3
0.2	0	-1.4	1.1	3.6	3.1
2.9	1	1.3	3.8	6.3	5.8
4.1	2	2.5	5.0	7.5	7.0
3.2	3	1.6	4.1	6.6	6.1

B \ G	0	1	2	3
0	16	15	10	11
1	14	9	4	6
2	12	7	1	2
3	13	8	3	5

Figure 2. A Number by Sex Difference Model (NxS)



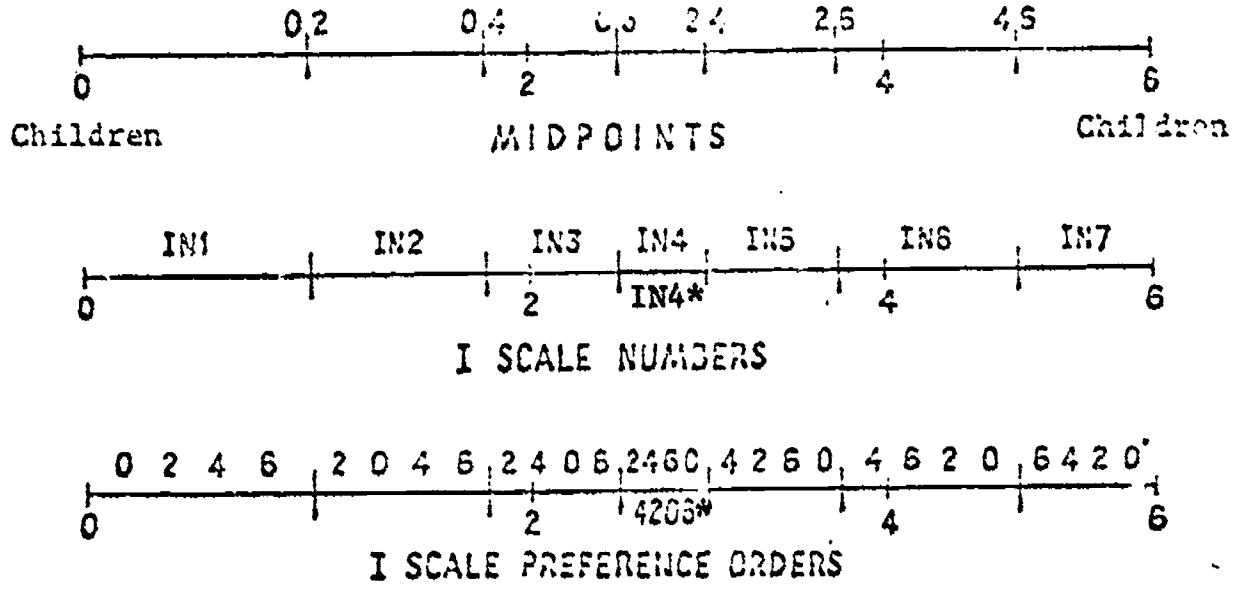
U_2(S)	Sex Difference	U_1(N) = -0.8	1.2	3.2	3.6	2.9	2.1	1.5
		Number of Children: 0	1	2	3	4	5	6
-0.7	-3				3.1			
0.3	-2			3.5		3.2		
1.3	-1		2.5		5.1		3.4	
2.3	0	1.5		5.5		5.2		3.8
3.2	1		4.4		7.0		5.3	
2.8	2			6.0		5.7		
0.8	3				4.6			

S \ N	0	1	2	3	4	5	6
-3				14			
-2			11		13		
-1		15		7		12	
0	16		4		6		10
1		9		1		5	
2			2		3		
3				5			

Figure 3

Correspondence Between Preference Orders

And Scale Values For Size Bias



*There are two preference orders which correspond to the fourth interval on the scale. They reflect a difference in metric relations. For some purposes, such as cross-cultural comparisons, it is useful to distinguish between them.

Table 1

I-Scale Numbers for Preference Orders for

Number and Sex of Children

Number Preference Order	I-Scale Number	Preference Order for Difference Between Boys and Girls*
0 2 4 6	I-1	-3 -1 1 3
2 0 4 6	I-2	-1 -3 1 3
2 4 0 6	I-3	-1 1 -3 3
2 4 6 0	I-4	-1 1 3 -3
4 2 0 6	I-4**	1 -1 -3 3
4 2 6 0	I-5	1 -1 3 -3
4 6 2 0	I-6	1 3 -1 -3
6 4 2 0	I-7	3 1 -1 -3

*Equivalently: $-3 \approx$ 0 boys, 3 girls

$-1 \approx$ 1 boy, 2 girls

$1 \approx$ 2 boys, 1 girl

$3 \approx$ 3 boys, 0 girls

**See footnote, Figure 3.

Table 2

Relation Between Size Bias and Number of Children in First Choice, University of Michigan Sample

Number in 1st Choice	I-Scale for Number of Children (IN) 1	2	3	4	5	6	7	Total	%
0	22							22	6.0
1	5	7	1	4				17	4.7
2	0	64	27	104				195	53.6
3	1	5	7	21	14	3	1	52	14.3
4				6	29	20	2	57	15.6
5					3	4	5	12	3.3
6							9	9	2.5
Total	28	76	35	135	46	27	17	364	100

Table 3

Relation Between Size Bias and Sex Bias,
University of Michigan Sample

boy ← IS → girl	small ← IN → large							Total	%
	1	2	3	4	5	6	7		
1	2	3	1	2				8	2.2
2	1	2	0	2	1			6	1.6
3	6	21	5	19	7	6	1	65	17.9
4	6	16	9	23	12	5	2	73	20.0
5	10	27	14	67	18	12	8	156	42.9
6	2	5	3	17	7	4	1	39	10.7
7	1	2	3	5	1	0	5	17	4.7
Total	28	76	35	135	46	27	17	364	100
%	7.7	20.9	9.6	37.1	12.6	7.4	4.7	100	

Table 4

Distributions of I-Scales for Number and for Sex of Children, for United States, the University of Michigan and Taiwan Pretest Data*

I-Scale Number	Number Bias		
	United States	University of Michigan	Taiwan
	Percentage		
1	3	8	0
2	18	21	0
3	20	10	0
4	25	37	36
5	17	12	41
6	9	7	21
7	9	5	2
Mean I-Scale number	4.0	3.8	4.9
	Sex Bias		
	Percentage		
1	2	2	0
2	9	2	0
3	19	18	1
4	20	20	8
5	27	43	46
6	21	11	39
7	2	5	4
Mean I-Scale number	4.3	4.5	5.3
Number of cases	(138)	(364)	(179)

* These data are based on methodological and pretest samples, and are not representative.

Table 5

Number of Live Births in Prospective Period by Parity and I-Scale Position, Adjusted for Family Income, Wife's Education, Religion, and First Preference for Number of Children

Detroit Longitudinal Data - 1962-1967*

Parity And I-Scale Position	Mean Number of Live Births in Followup Period Adjusted for: Actual	First Preference	Income, Education, Religion	Income, Education, Religion First Preference	(N)
Zero Parity					
Low	1.44	1.81	1.43	1.71	(43)
Medium	1.68	1.69	1.75	1.74	(57)
High	2.32	2.06	2.28	2.08	(59)
First Parity					
Low	1.17	1.27	1.26	1.31	(120)
Medium	1.56	1.53	1.56	1.55	(114)
High	1.95	1.87	1.83	1.77	(85)
Second Parity					
Low	0.51	0.67	0.59	0.69	(118)
Medium	1.11	1.09	1.11	1.09	(113)
High	1.53	1.38	1.48	1.34	(77)
Fourth Parity					
Low	0.56	0.42	0.63	0.48	(32)
Medium	0.47	0.56	0.50	0.59	(137)
High	1.02	0.95	0.96	0.90	(127)
Total					
Low	0.91	1.01	0.97	1.03	(313)
Medium	1.10	1.10	1.11	1.12	(421)
High	1.58	1.49	1.51	1.45	(348)

*Based on a panel study of 1304 white married women in the childbearing ages. This analysis is limited to fecund women remaining in the study for the entire followup period.

REFERENCES

The following publications provide more detail about conjoint measurement and use of the scales developed. A limited number of copies of items marked with an asterisk are available to interested persons on request.

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